ENCAPSULATED PYRIDAZINE Cr(III) COMPLEXES PREPARED BY BIOSORBENTS SUPPORTED IN ZEOLITES

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Heavy metal such as cadmium (Cd), chromium (Cr) and lead (Pb) are toxic priority pollutants in aqueous waste streams of many industries, such as metal plating facilities, mining operations and tanneries. The soils are contaminated and pose a risk of metals groundwater and surface water contamination. Numerous processes exist for removing these metals including chemical precipitation, ion exchange, membrane filtration and carbon adsorption [1].

Cost effective alternative technologies or sorbents for treatment of metals contaminated waste streams are needed. In this regard, the zeolites have a great potential to remove heavy metal from industrial wastewater. The existence a net negative structural charge in the structure promotes a strong affinity for metal cations which give adsorptive properties to these supports. Sodium, potassium and other positively charged exchangeable ions occupy the channels within the three-dimensional structure and can be replaced by heavy metals [2].

Microorganisms are quite adequate for heavy metals biosorption, due to their ability to sorb metal ions, suitability for natural environments and low cost. *Arthrobacter viscosus* is a good exopolysaccharide producer, which, by itself, would allow foreseeing good qualities for support adhesion and for metal ions entrapment. The new system combines the biosorption properties of the microorganism with some characteristics of the heterogeneous catalysts, such ion exchange properties and shape selectivity [3].

One of the approaches for the preparation of redox-active zeolite catalysts is the encapsulation of metal complexes in the zeolite channels where the general idea is to combine the solution like activity with shape-selective control induced by the zeolite.

In this work we report the encapsulation of a pyridazine Cr(III) complex prepared by a robust biosorption system consisting of a bacterial biofilm supported on faujasite zeolites. The NaY or NaX as a support was placed in inoculated medium based in *Arthrobacter viscosus* bacterium, in batch experiments. This new system, the biosorbent supported in zeolites was tested with low concentration of chromium. Total metal cations concentrations were measured with by atomic absorption spectrophotometry. The results showed that the maximum removal efficiency was 20% for chromium in the both systems based in NaY or NaX, and the *Arthrobacter viscosus* bacterium supported in zeolite reduces Cr(VI) to Cr(III). Cr(III) is retained in the zeolite by ion exchange and the metal is coordinated with 3-Ethoxy-6-Choropyridazine ligand (Figure 1).

Cr(III) complex with pyridazine ligand is typically four coordinate with a planar geometry around the metal centre. This low coordination geometry allows the metal centre to axially coordinate extra ligands, which can be the zeolite framework (inducing a more effective complex encapsulation) and leaving the other coordination site for the oxidant in the catalytic reactions [4].

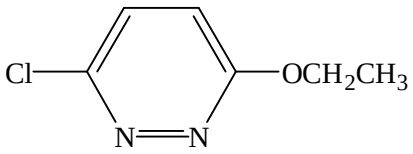

Figure 1: 3-Ethoxy-6-Choropyridazine ligand

These occluded complexes in different zeolites were characterized by chemical analysis, spectroscopic methods (FTIR and UV/Vis) and surface analysis (DRX). The various techniques of characterization used are compatible with the fact that the Cr(III) complex was effectively encapsulated in the zeolite and this process does not modified the morphology and structure of the NaY/NaX zeolites.

References

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